INTERNSHIP PROPOSAL

Laboratory name: SIMM
CNRS identification code: UMR 7615
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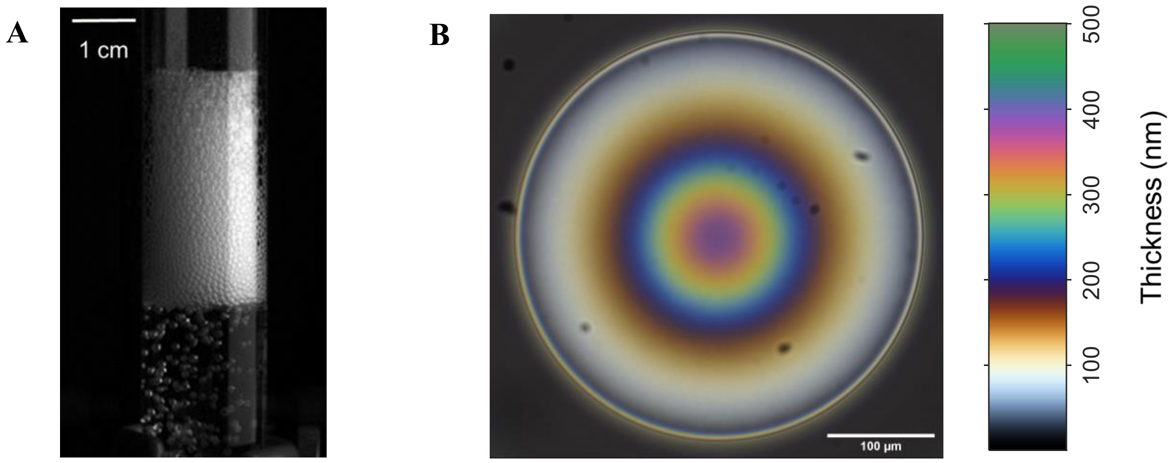
Internship location: Laboratoire SIMM, ESPCI Paris, 10 rue Vauquelin 75005 Paris

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: CIFRE

Foam stability : from bubbles in a macro foam to single liquid films

Processes involving liquids often face unwanted foaming issues (eg lubrication), while foaming is instead desired when the intimate mixing of a gas and a liquid phase is needed (eg. chemical reaction with O_2). Hence, controlling the bubble lifetime can be crucial to applications. Extensive studies have been conducted on aqueous foams stabilized by surfactants, and have unveiled intricate mechanisms due to the molecular adsorption of the surfactants at the air/liquid interface. Recently, foaming of liquid mixtures has emerged as a model system to isolate some of the physical mechanisms ensuring bubble stability. Indeed, interfacial effects due to evaporation can be minimized, delays in interfacial adsorption are suppressed, thereby reducing the couplings between bulk and interface transfers. In addition, foaming of liquid mixtures is relevant to a large number of practical situation in which foams exist without adding surfactants.

The purpose of this internship is to further describe the physical mechanisms acting to stabilize foams of two mixed liquids [1]. To do so, we will perform experiments in order to quantitatively relate the lifetime of a bubble in a macroscopic column of foam (Image A) to that of a single suspended liquid film (Image B). We will particularly explore the effects of the bubble radius which sets the curvature and hence the capillary pressure gradients. These experiments will be analyzed and interpreted to improve our understanding of the stabilizing mechanisms in oil foams.



(A) *Measurement of the foamability of a liquid mixture in a column by air injection from the bottom: we measure the height of foam depending on the liquid composition.* (B) *Observation of a thin liquid film using white-light interferometry, allowing for the reconstruction of the film thickness profile: bursting is observed when the thickness decreases down to 50 nm.*

[1] Tran et al, *Physical Review Letters*, 2020, 125, 178002

Condensed Matter Physics: NO Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: NO